

# DISTRIBUTION AND ZOOGEOGRAPHY OF NEW ZEALAND MEGALOPTERA AND NEUROPTERA

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*Abstract.* The 1 Megaloptera species and 15 Neuroptera species occurring in the New Zealand subregion are listed and their distributions and suggested status given. The Neuroptera include 7 endemic, 4 indigenous and 4 introduced species. Distributions within the subregion are given in a table and illustrated in maps. Wider distributions for all species are also given in a table. The indigenous species are common to Australia and New Zealand and are considered to be wind-borne in New Zealand. The overall distribution of these species are illustrated in maps, by family. In each of three family maps another, non-New Zealand, species is shown for comparison. The endemic species may have arisen through an ancient Gondwanaland connection with Australia and South America. The distributions of all species are shown diagrammatically to illustrate possible zoogeographical relationships.

The New Zealand Megaloptera fauna consists of 1 endemic aquatic species. The Neuroptera fauna is made up of 7 endemic species, 4 indigenous species common to Australia and New Zealand, and 4 accidentally introduced species. (Species purposely introduced as pest predators are not included as none have established.) Table 1 lists the 16 species and gives their suggested status.

Two Chrysopid species referred to in this paper have been largely recorded in literature and in specimen collections as *Chrysopa basalis* and *Chrysopa ramburi* but in more recent years this genus has been divided considerably (see Brooks & Barnard 1990). The current combinations for the two species are given in Table 1 (for the New Zealand species, as *Mallada basalis*) and in the text (for the exotic species, as *Plesiochrysa ramburi*) but elsewhere combinations with *Chrysopa* are retained for comparative purposes.

## NEW ZEALAND DISTRIBUTIONS

In Table 2 the Megaloptera and Neuroptera species are listed with their limits of distribution within the New Zealand subregion.

The distributions are based on north and south limits previously published (Wise 1963), on later publications [Wise 1971 (subantarctic islands), 1972 (Kermadec Is), 1973 (introduced species), 1983b (northern records), 1983c (off-shore islands), 1985 (off-shore islands) and 1988 (new introductions and northern records)] and on more recent specimen identifications.

Table 1. Megaloptera and Neuroptera of the New Zealand subregion.

## MEGALOPTERA

## CORYDALIDAE

## Chauliodinae

*Archichauliodes* van der Weele, 1909*Archichauliodes diversus* (Walker, 1853) Endemic — NZ

## NEUROPTERA

## CONIOPTERYGIDAE

## Aleuropteryginae

*Heteroconis* Enderlein, 1905*Heteroconis ornata* Enderlein, 1905 Introduced — ex Australia*Cryptoscenea* Enderlein, 1914*Cryptoscenea australiensis* (Enderlein, 1906) Indigenous — Australia, NZsr

## BEROTHIDAE

## Berothinae

*Protobiella* Tillyard, 1923*Protobiella zelandica* Tillyard, 1923 Endemic — NZ

## HEMEROBIIDAE

*Drepanacra* Tillyard, 1916*Drepanacra binocula* (Newman, 1838) Indigenous — Australia, NZsr, Pacific Is*Micromus* Rambur, 1842*Micromus tasmaniae* (Walker, 1860) Indigenous — Australia, NZsr, Pacific Is*Micromus bifasciatus* Tillyard, 1923 Endemic — NZ*Wesmaelius* Kruger, 1922*Wesmaelius subnebulosus* (Stephens, 1836) Introduced — ex Europe*Psectra* Hagen, 1866*Psectra nakaharai* New, 1988 Introduced — ex Australia

## CHRYSOPIDAE

*Mallada* Navas, 1925*Mallada basalis* (Walker, 1853) Indigenous — Australia, NZsr, Pacific Is*Mallada* sp. nr. *alcestes* (Banks, 1911) Introduced — ex Pacific Is

## OSMYLIDAE

## Kempyninae

*Kempynus* Navas, 1912*Kempynus incisus* (McLachlan, 1863) Endemic — NZ*Kempynus citrinus* (McLachlan, 1873) Endemic — NZ*Kempynus latiusculus* (McLachlan, 1894) Endemic — NZ*Euosmylus* Kruger, 1913*Euosmylus stellae* (McLachlan, 1899) Endemic — NZ

## MYRMELEONTIDAE

## Myrmeleontinae

*Weeleus* Navas, 1912*Weeleus acutus* (Walker, 1853) Endemic — NZ

Table 2. Distribution of Megaloptera and Neuroptera in the New Zealand subregion.

	Kermadec Is	North I	Northern off-shore islands	South I	Stewart I	Chatham Is	Antipodes Is	Auckland Is
MEGALOPTERA								
Corydalidae								
<i>Archichauliodes diversus</i>		+	+(3)*	+				
NEUROPTERA								
Coniopterygidae								
<i>Heteroconis ornata</i>		+						
<i>Cryptoscenea australiensis</i>	+	+	+(1)	north				
Berothidae								
<i>Protobiella zelandica</i>		+		+				
Hemerobiidae								
<i>Drepanacra binocula</i>	+	+	+(6)	+		+		
<i>Micromus tasmaniae</i>	+	+	+(13)	+		+	+(?intro)	+(intro)
<i>Micromus bifasciatus</i>		+		+	+			
<i>Wesmaelius subnebulosus</i>		+		+				
<i>Psectra nakaharai</i>		+						
Chrysopidae								
<i>Chrysopa basalis</i>	+		+(1)					
<i>Mallada</i> sp.		+						
Osmylidae								
<i>Kempynus incisus</i>		+		+				
<i>Kempynus citrinus</i>		+						
<i>Kempynus latiusculus</i>		middle		middle				
<i>Eosmylus stellae</i>		middle		middle				
Myrmeleontidae								
<i>Weeleus acutus</i>		+	+(2)	+				

\* Number of northern off-shore islands groups.

Almost New Zealand-wide endemic species are shown in Fig. 1.

In the Megaloptera, *Archichauliodes diversus* has been recorded from the north of the North I to the south of the South I and from off-shore islands.

In the Neuroptera, *Protobiella zelandica* is still known only from the earlier north to south limits (Wise 1963). *Micromus bifasciatus*, known in 1963 from mid-North I to the south of the South I, has since been recorded further north and is now known from specimens taken on Stewart I. *Kempynus incisus*, recorded earlier from a northern North I area to a southern South I area, is now known further north from specimens collected.

Distributions of the other endemic Neuroptera species are shown in Fig. 2.

*Kempynus citrinus* is restricted to the North I but has been collected further north than it was earlier. *Kempynus latiusculus* and *Eosmylus stellae* occur from the central North I plateau to the middle of the South I as earlier recorded. *Weeleus acutus* has been taken further north in the North I than before and has also been found on the northern off-shore islands. The southern limit remains the same.

The species here considered to be indigenous, having been naturally distributed to New Zealand by wind, are given in Fig. 3. They all occur on the Kermadec Is. The occurrence of all four species on the New Zealand northern off-shore islands is further evidence of their mobility.

*Cryptoscenea australiensis* was earlier noted from the northern North I to the northern South I and has since been recorded from the Kermadec Is, from further north on the North I than before and from an off-shore island.

*Drepanacra binocula* was earlier known from Kermadec Is, from the northern North I to the south of the South I, and from Chatham Is. Specimens have since been collected further north in the North I and from off-shore islands.

*Micromus tasmaniae* was known from the northern North I to the south of the South I and from Chatham Is. Records for the subantarctic Auckland and Antipodes Is may have resulted from artificial introductions. The species has also been recorded from the Kermadec Is, from off-shore islands and has been collected further north in the North I.

*Chrysopa basalis* has been recorded from the Kermadec Is and from one small island off the northern North I.

The species indicated in Fig. 4 are here considered to be accidentally introduced as there is no evidence of them occurring naturally.

*Heteroconis ornata* was first recorded in New Zealand from a specimen collected in Auckland in 1988. Another was taken at the same place in 1990 and a small colony found in the outer western suburbs in 1989, so the species is established locally.



*Archichauliodes diversus*  
*Protobiella zelandica*  
*Micromus bifasciatus*  
*Kempynus incisus*

KERMADEC  
 IS

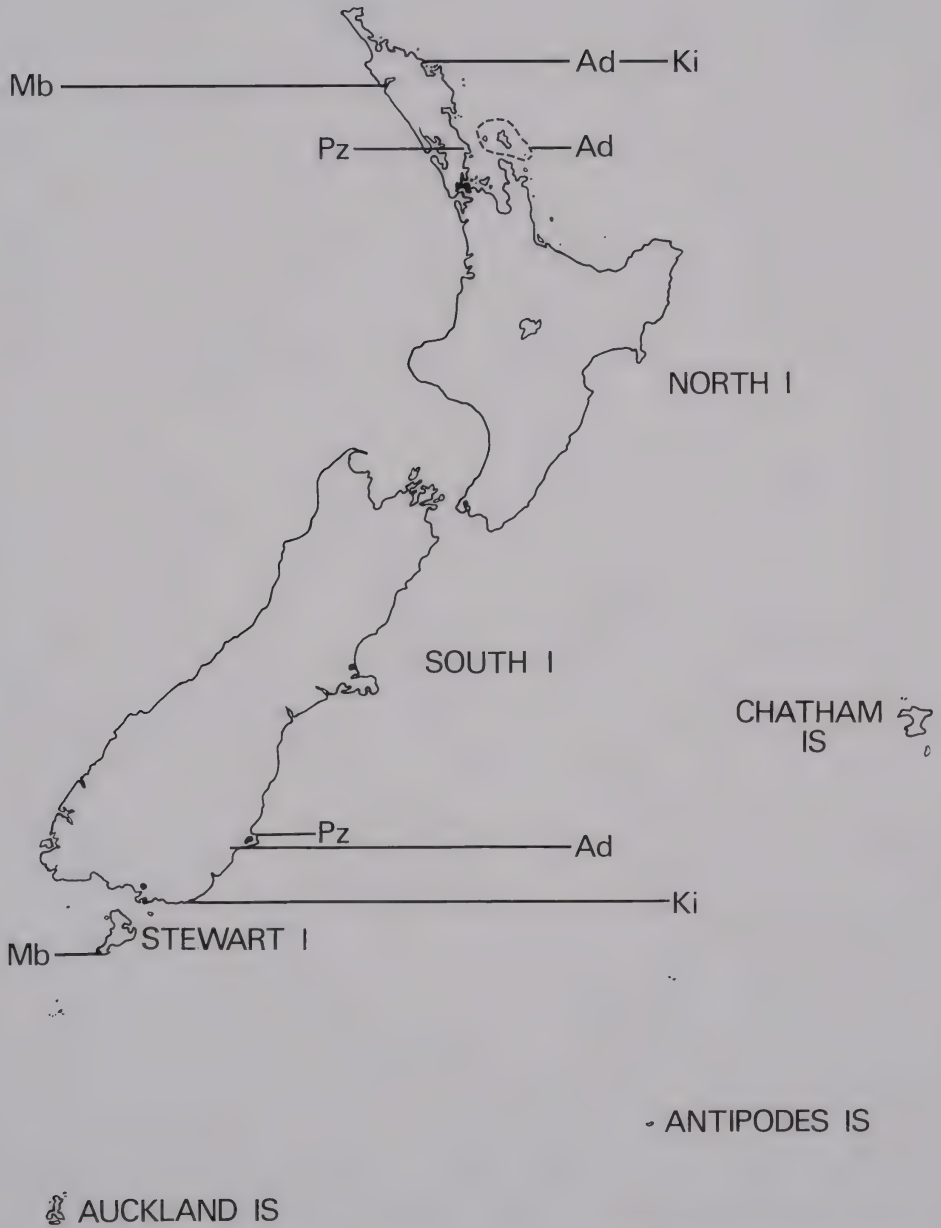


Fig. 1. New Zealand subregion. Distribution limits of New Zealand-wide endemic Megaloptera and Neuroptera species.

*Kempynus citrinus*  
*Kempynus latiusculus*  
*Eosmylus stellae*  
*Weeleus acutus*

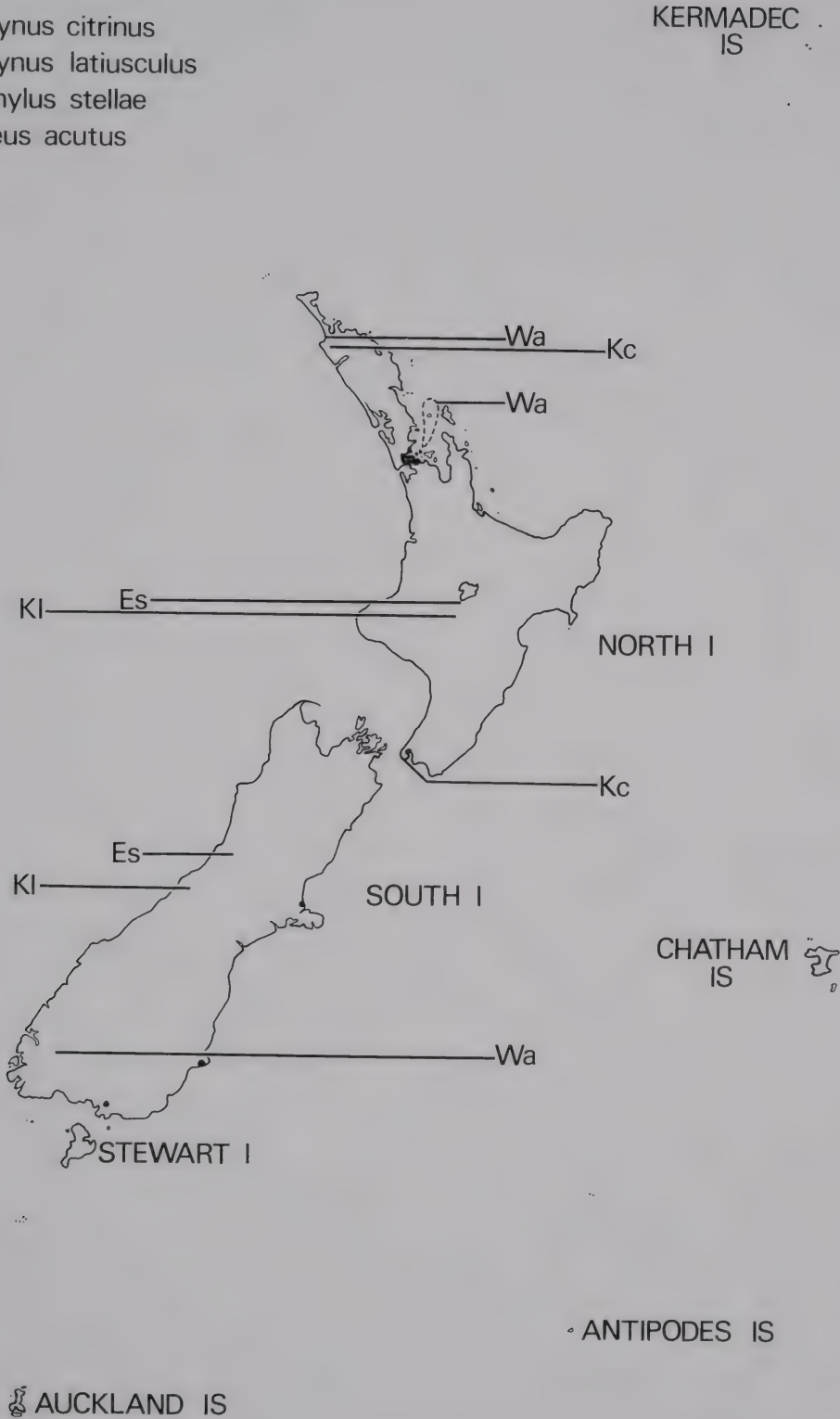


Fig. 2. New Zealand subregion. Distribution limits of other New Zealand endemic Neuroptera species.

Ca ————— Cb ————— Db — Mt —————

*Cryptoscenea australiensis* KERMADEC IS  
*Drepanacra binocula*  
*Micromus tasmaniae*  
*Chrysopa basalis*

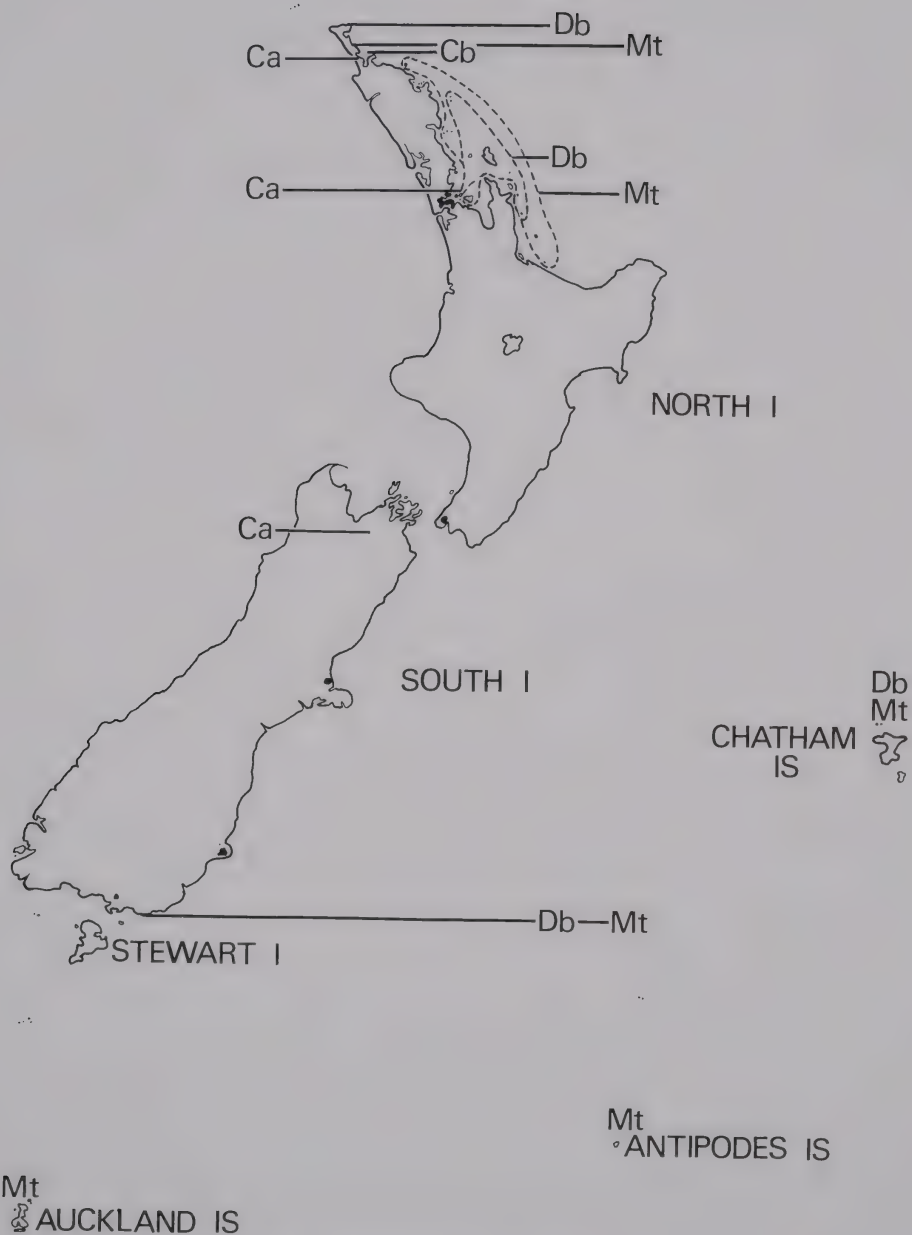


Fig. 3. New Zealand subregion. Distribution limits of New Zealand indigenous Neuroptera species.

*Heteroconis ornata*  
*Wesmaelius subnebulosus*  
*Psectra nakaharai*  
*Mallada* sp

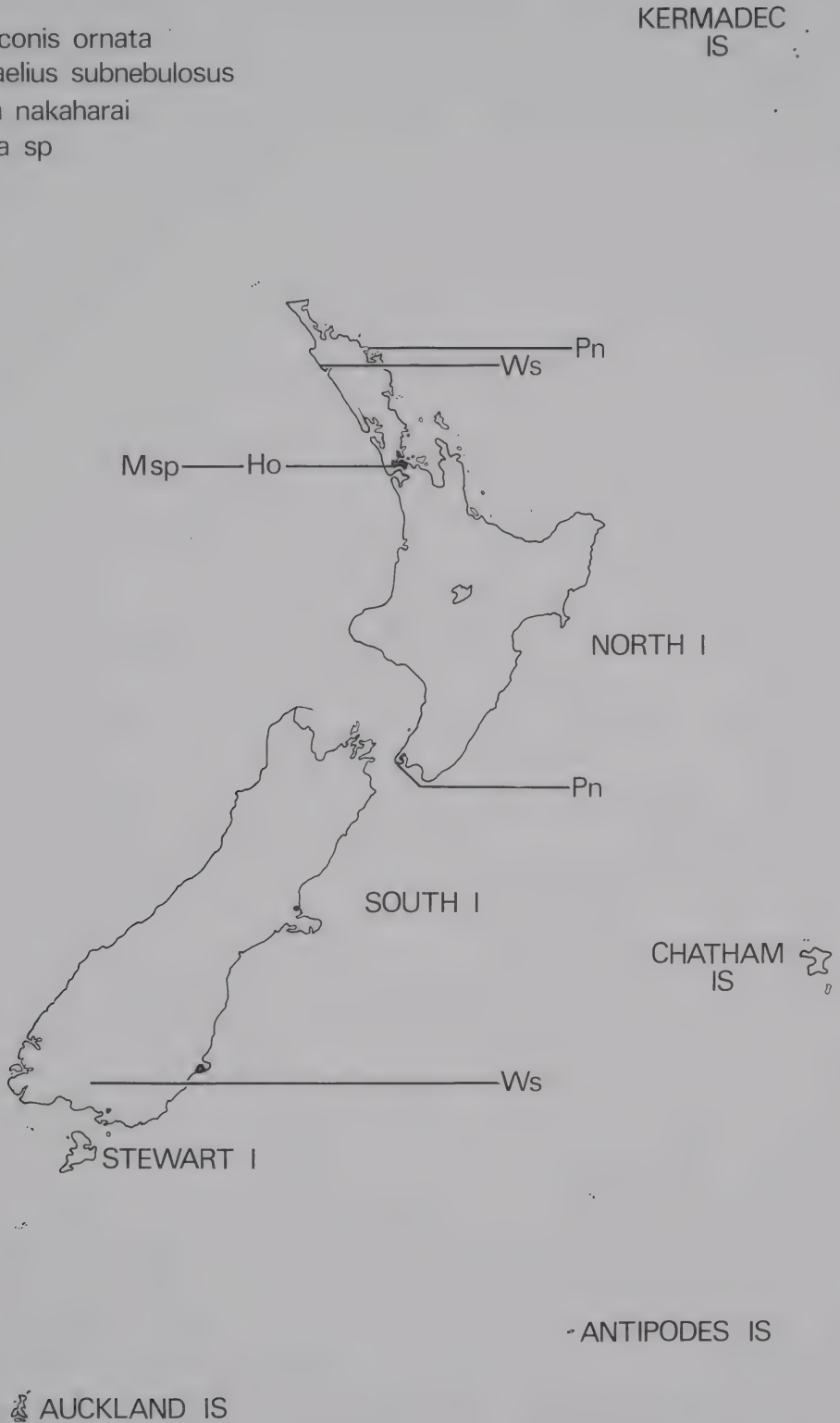


Fig. 4. New Zealand subregion. Distribution limits of New Zealand accidentally introduced Neuroptera species.



*Wesmaelius subnebulosus* was first collected in New Zealand in Dunedin in 1920. It is a common European species although first recorded in New Zealand as an endemic species, *Boriomyia maorica* Tillyard, 1923. It became widespread in both the North and South Is and is now known further north and further south.

*Psectra nakaharai* was first taken in the outer western suburbs of Auckland in 1971 and was recorded temporarily in the *Symphorobius* group. It is now widespread in the North I.

One live Chrysopid, taken on pineapple in Auckland in 1988, was first recorded as *Chrysopa* sp. and thought possibly to be an import from Australia. It is now recognised as *Mallada* sp. near *alcestes*, a species which is not recorded from Australia but is known from north-western Pacific Is.

#### WIDER DISTRIBUTIONS

In Table 3 general distributions for all species are given.

Further consideration of the species indigenous to New Zealand suggests distribution by west wind drift. This well-known phenomenon is responsible for the occurrence of many insects in the Pacific and New Zealand. However, the continual west wind is at high altitudes and I suggest that many insects are blown across the Tasman Sea at lower altitudes. Low pressure systems circulating in a clock-wise direction traverse the Tasman Sea from below Australia and any insects picked up on the front of the system would be carried southwards and eastwards and would thus travel in an arcuate or sigmoid curve. The possibility of low altitude flights by insects, including lacewings, has been well confirmed by dispersal studies with nets and collections on ships at sea (Wise 1983a).

In the Coniopterygidae (Fig. 5) *Cryptosceneae australiensis* occurs in eastern Australia (Meinander 1979) and extends eastwards to Kermadec Is and New Zealand (as above). By comparison *Cryptosceneae obscurior* Meinander, 1972 is distributed from Queensland and New South Wales to Lord Howe I (Meinander 1979, Lambkin & New 1989).

The Hemerobiidae (Fig. 6) includes two widely spread and common species. *Drepanacra binocula* occurs in most states of Australia (New 1988) and extends eastwards and southwards to Lord Howe I (confirmed by specimen in ANIC, Canberra), Norfolk I (New 1987), Kermadec Is and New Zealand. *Micromus tasmaniae* is widespread throughout Australia (New 1988), and is present eastwards on New Caledonia (Nakahara 1960), New Hebrides (Kimmins 1958), Lord Howe (Lambkin & New 1989), Norfolk (New 1987) and Kermadec Is, and in New Zealand. In addition, *Micromus tasmaniae* has been taken at sea several times during dispersal projects (Pacific — Wise 1983a; Australia — unpubl.) as indicated by the arrows (Fig. 6) which show the ship direction and distance of travel since the start of a net run or the previous collection (numbers in brackets are specimens where more than one).

Table 3. Distributions of New Zealand Megaloptera and Neuroptera in Australia and the South Pacific.

	Australia	New Caledonia New Hebrides	Lord Howe I	Norfolk Is	Kermadec Is	New Zealand	Samoa	Cook Is	Society Austral Tuamotu Marquesas Easter Is
MEGALOPTERA									
Corydalidae						+			
<i>Archichauliodes diversus</i>									
NEUROPTERA									
Coniopterygidae						+			
<i>Heteroconis ornata</i>	+					+			
<i>Cryptoscenea australiensis</i>	+				+				
Berothidae									
<i>Protobiella zelandica</i>						+			
Hemerobiidae									
<i>Drepanacra binocula</i>	+		+	+	+	+			
<i>Micromus tasmaniae</i>	+	+	+	+	+	+			
<i>Micromus bifasciatus</i>						+			
<i>Wesmaelius subnebulosus</i>						+			
<i>Psectra nakaharai</i>	+					+			
Chrysopidae									
<i>Chrysopa basalis</i>	+	+			+	+	+	+	+
<i>Mallada</i> sp.						+			
Osmylidae									
<i>Kempynus incisus</i>						+			
<i>Kempynus citrinus</i>						+			
<i>Kempynus latiusculus</i>						+			
<i>Eosmylus stellae</i>						+			
Myrmeleontidae									
<i>Weeleus acutus</i>						+			

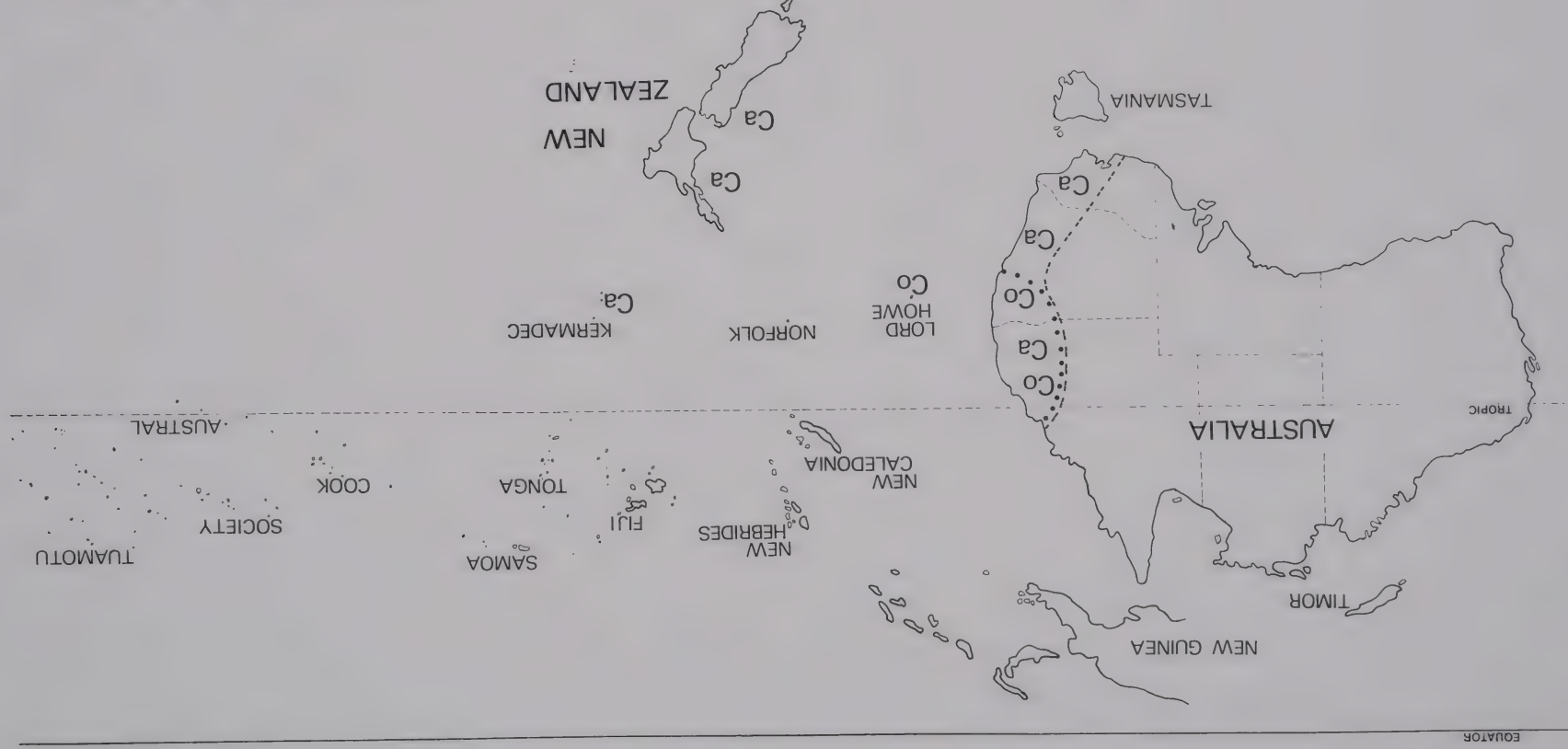


Fig. 5. Southern Pacific area. Distribution of Neuroptera: Coniopterygidae species.

*Cryptoscenea australiensis*  
*Cryptoscenea obscurior*

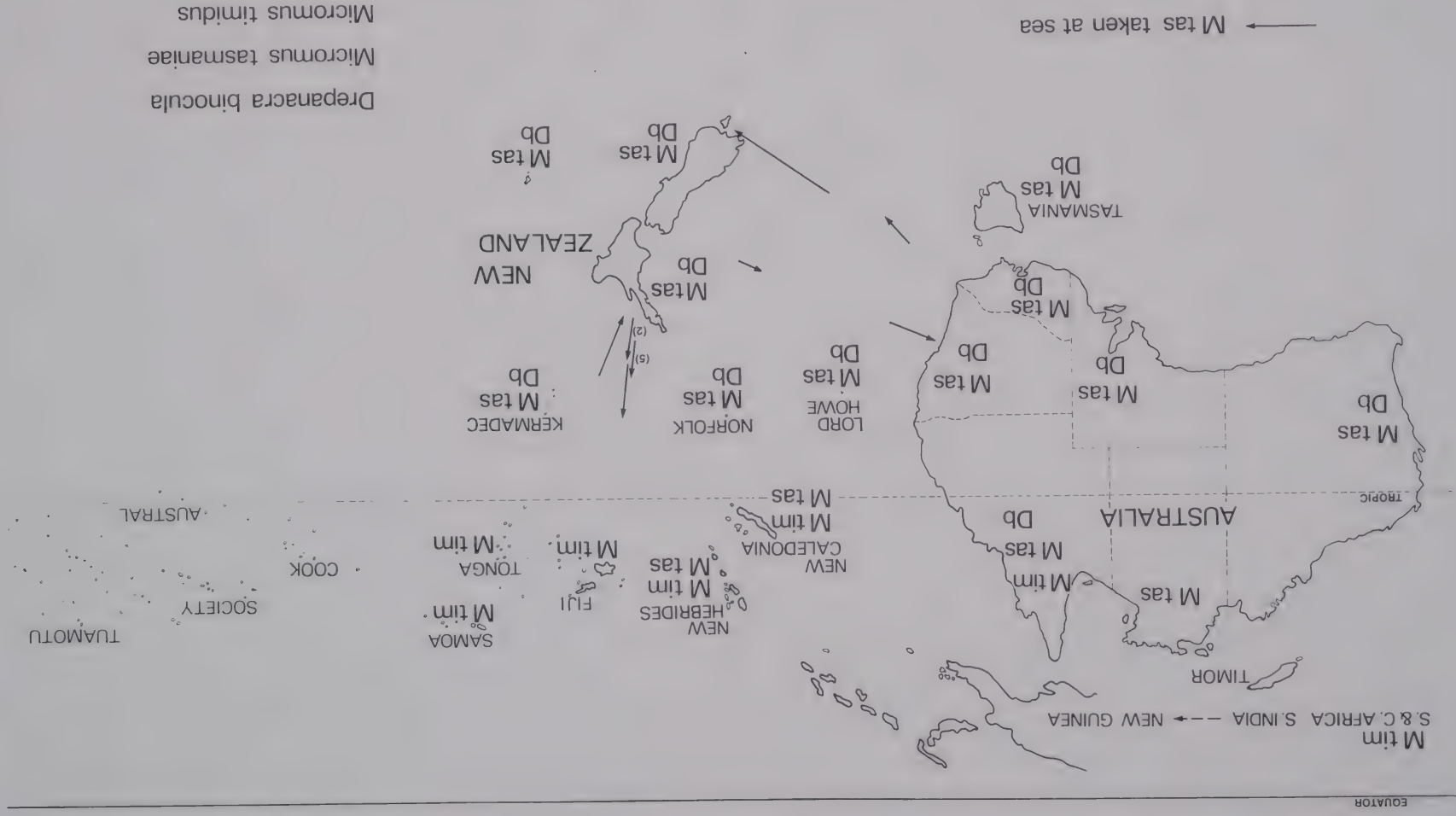


Fig. 6. Southern Pacific area. Distribution of Neuroptera: Hemerobiidae species.



By contrast, *Micromus timidus* Hagen, 1853 is naturally widespread from South and Central Africa eastward through the tropical belt to New Guinea, northern Queensland (in Australia), New Caledonia, New Hebrides, Fiji, Samoa (Tjeder 1961) and Tonga (from specimens).

In the Chrysopidae several species occur in Australia and are widespread in the tropical belt eastwards across the Pacific. For example (Fig. 7), *Chrysopa ramburi* [now *Plesiochrysa ramburi* (Schneider, 1851)] is recorded in Malaya, Timor, the whole of Australia (except Tasmania), Lord Howe I (New 1980), and islands to the east as far as Tonga, Samoa, Society Is (Adams 1959, New 1980) and Cook Is (Walker & Dietz 1979). Only *Chrysopa basalis*, which occurs in Eastern Australia (New 1980), New Caledonia (Kimmins 1958), New Hebrides (Kimmins 1958) and island groups further north, has extended further south as well as eastwards. It is recorded through the Pacific Is from Samoa to Easter I (Adams 1959), including the Cook Is (Walker & Deitz 1979), in the Kermadec Is and on a small off-shore island in the far north of New Zealand.

#### ZOOGEOGRAPHY

The zoogeographical relationships of the New Zealand Megaloptera and Neuroptera (Fig. 8) appear to be mainly with Australia.

In the Megaloptera, *Archichauliodes* contains many species in Australia (Theischinger 1983), one in New Zealand and is present in South America. This distribution suggests a connection through the ancient southern Gondwanaland and the New Zealand species has been noted (Riek 1954) as being close to one of the Australian species, *A. anagaurus* Riek, 1954.

In the Neuroptera, the two Coniopterygid species are Australian.

The Berothid endemic genus *Protobiella* is in the Berothinae and (according to Aspöck & Aspöck 1985) is most closely related to an Australian genus *Austroberothella* Aspöck & Aspöck, 1985. It may have an association through a southern Gondwana influence.

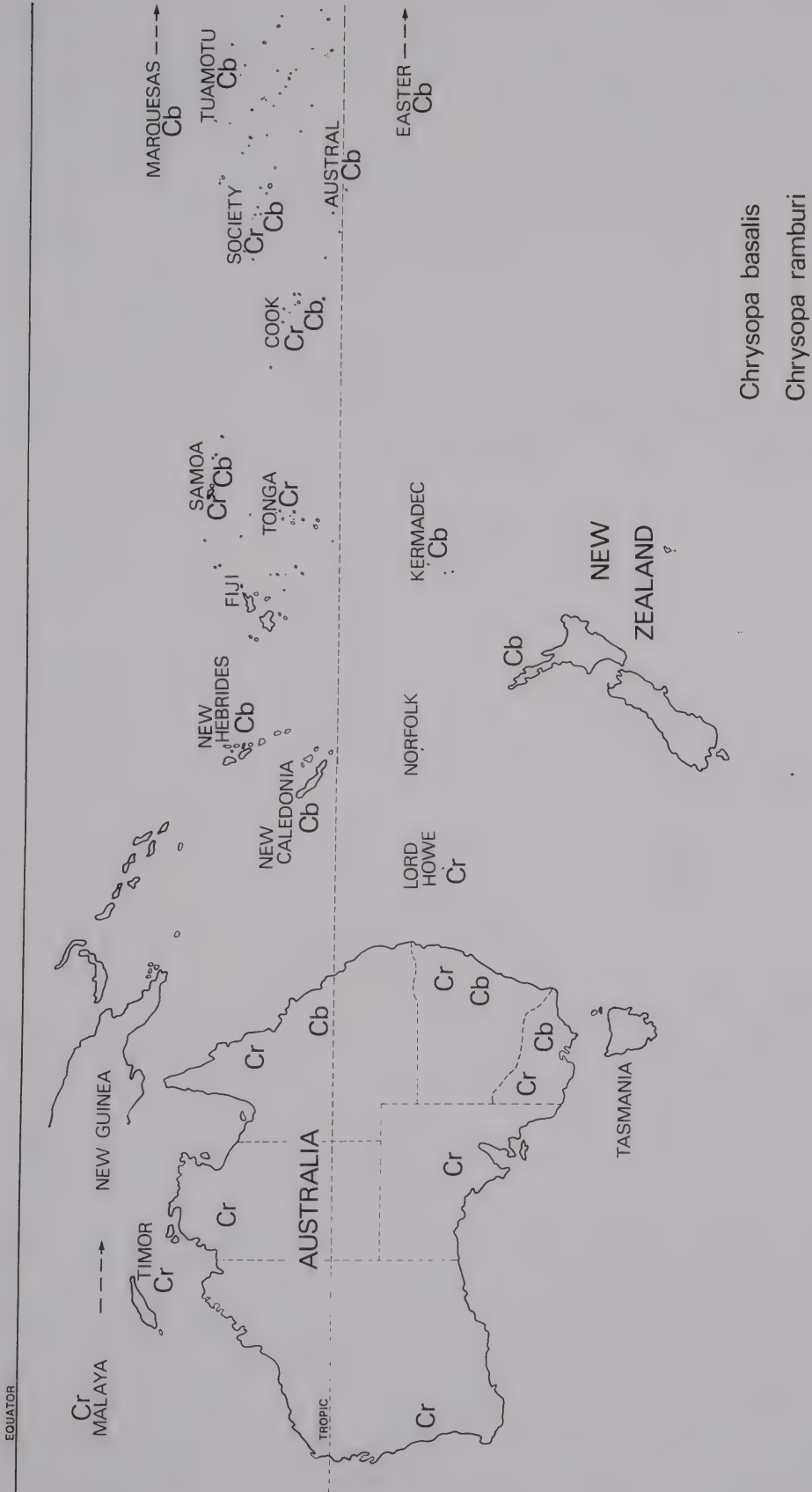
Three of the five species of Hemerobiidae are Australian. The endemic *Micromus bifasciatus* is very close to *M. tasmaniae* and also may have arisen following the southern Gondwana connection. The fifth species was introduced from Europe.

One of the Chrysopid species is also present in Australia and the Pacific Is, while the other may be introduced from the Pacific Is.

The four endemic species in the Osmylidae are in two related genera, *Kempynus* and *Euosmylus* of the Kempyninae. *Kempynus* also contains species in Australia and South America suggesting a southern Gondwana influence.

The one Myrmeleontid species is in the endemic genus *Weeleus* which is very close to the world-wide *Myrmeleon* and may also have separated from an Australian line since a southern Gondwana separation.





*Chrysopa basalis*  
*Chrysopa ramburi*

Fig. 7. Southern Pacific area. Distribution of Neuroptera: Chrysopidae species.

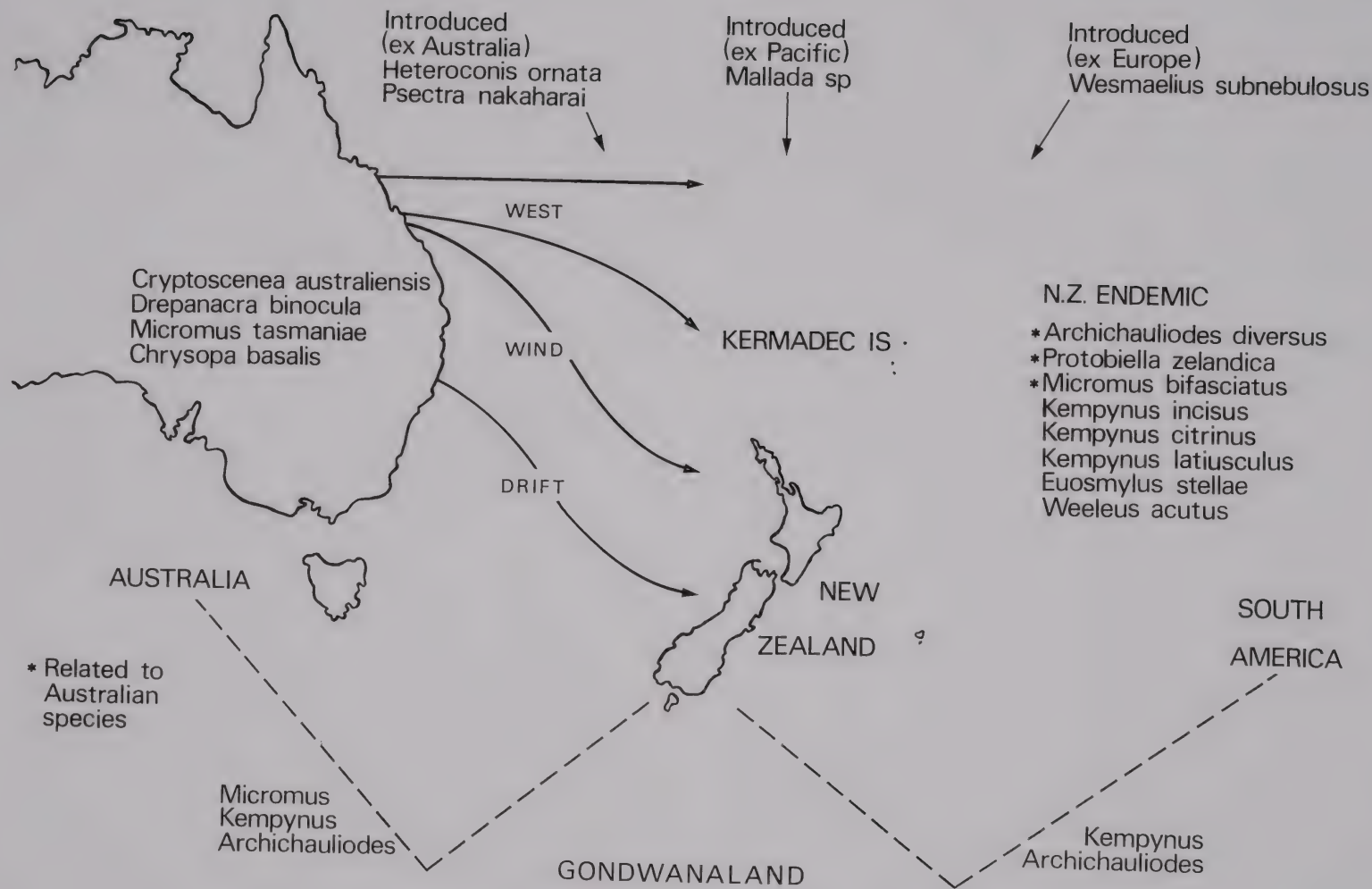


Fig. 8. Schematic diagram indicating possible zoogeographical relationships of New Zealand Megaloptera and Neuroptera.

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